MIT Rocket Team

Sponsorship Packet

The Team

The MIT Rocket Team is a well-established, independent student group dedicated to high-quality, groundbreaking engineering in rocketry and educational outreach. In its 18-year history, the team has taken on a variety of challenging projects, such as a custom aerospike liquid engine and a collapsible, rocket-deployed UAV. The team currently flies in the Intercollegiate Rocket Engineering Competition (IREC). MIT Rocket Team also provides all of its members with the tools and knowledge needed to earn high-power rocketry (HPR) certifications through the National Association of Rocketry (NAR).

Members presenting their Preliminary Design Review (PDR) for IREC 2016

Reorganization of the Rocket Team lab

As a club recognized by the MIT Association of Student Activities and the MIT Edgerton Center, Rocket Team is currently composed of 50 MIT undergraduate students, 5 graduate students, 3 MIT alumni and a faculty advisor. Membership is open to all members of the MIT community, and new members are always welcome and encouraged to attend meetings.

Many members of Rocket Team commonly intern and then work full-time at aerospace companies such as NASA, SpaceX, Boeing, Virgin Galactic, Airbus, Lockheed Martin and Northrop Grumman.

(left) Start of year team meeting covering year-round goals

Team Learning

The MIT Rocket Team helps all of its members to become familiar with the basics of rocket design and theory, and to apply this knowledge by building and launching their own Estes and high-power certification rockets.

Members prepare their rockets for launch in Berwick, Maine

In the first few weeks, new members learn about the fundamentals of rocketry through several build and launch sessions. Each new member builds a rocket from a provided Estes kit powered by a C-impulse class motor, and add ballast to their rocket for optimal stability. Members can launch their rockets at Amesbury, MA, Berwick, ME or Potter, NY.

After team members launch their Estes rocket, we encourage them to continue by building a NAR (National Association of Rocketry) Level 1 certification rocket, furthering their engineering experience and introducing them to the rocketry community.

We also offer lectures to the team, covering industry skills not available in MIT's classes.

Member displays his level 1-certified high-powered rocket

Estes rockets:	High-powered rockets:	Team lectures:
Fundamentals of rocketry (center of gravity vs pressure)	Further rocketry knowledge (stability margins)	Trajectory simulation
Introduction to solid motors	Safe handling of high-powered rocket motors	Propulsion (solid, liquid) & thermodynamics
Rocket recovery	Avionics	Thermodynamics
Rocket assembly	Machining, composite layups	CAD modeling

Skills students learn in Rocket Team learning programmes

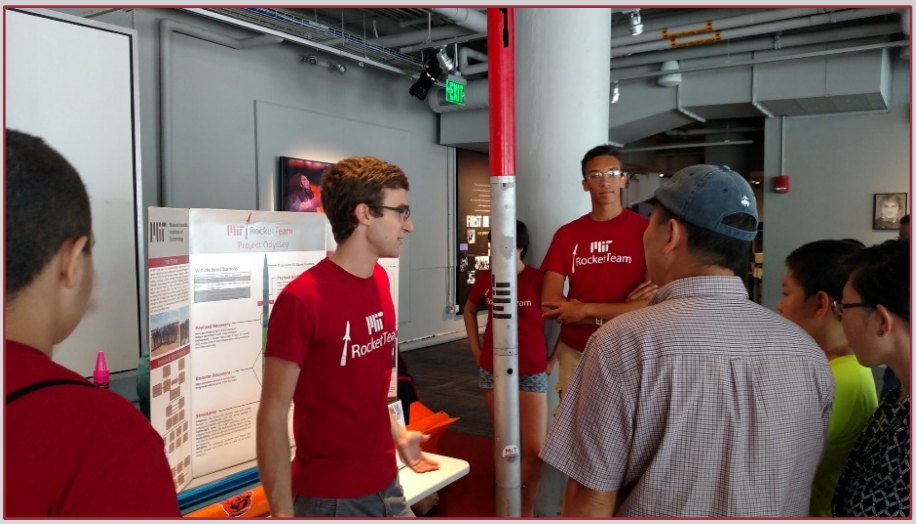
Outreach

One of the driving missions of the MIT Rocket Team is to educate and foster interest in science, engineering and space flight. To accomplish this goal, the team participates in numerous outreach events within the MIT community and at museums in the Boston area.

Member talks about Rocket Team to families at annual Family Weekend Fair Booth

Every year, team members participate in the **Splash**, **Spark** and **Sprinkler** programs hosted by the MIT Educational Studies Program (ESP). Through these programs, Rocket Team teaches introductory rocketry classes to visiting middle- and high-school students to generate interest in the STEM fields. We also plan to further expand our outreach efforts by leading **workshops and seminars** for local children and families.

Rocket Team also participates in the **Cambridge Science Festival**, a week-long event for children and families to engage them in science-related activities, and **KEYS**, a series of workshops hosted by the MIT Society of Women Engineers that provides middle school girls with resources and opportunities to explore STEM career paths.



Rocket Team presents at the MIT Museum

The Team presents several **MIT Museum exhibits** (above), throughout the year. Here, members display and explain the projects and offer ways for children to get involved in hobby rocketry in their own communities.

Members also organize outreach events outside of the MIT community

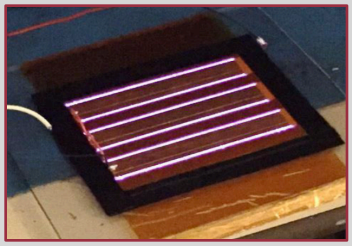
2015-2016 Accomplishments

Project Therion lifts off in Green River, UT.

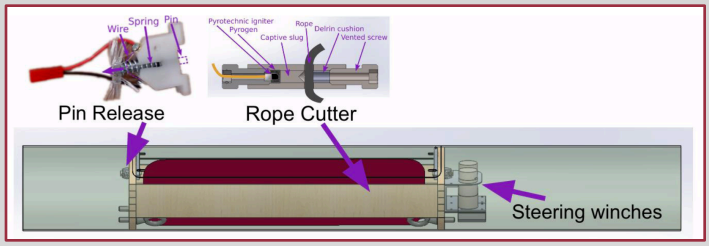
Rocket Team had an incredible year from start to finish. First, the lab was renovated. It now features dedicated areas for composites, 3D printing, parachute manufacturing, electronics fabrication and rocket integration. This new lab space streamlined **12 certifications** during the year.

During renovations, the team made a conceptual design for **Therion**: a sounding rocket to participate in the Intercollegiate Rocket Engineering Competition (IREC). The challenge: launch and recover a rocket with a 10 pound payload to a 10,000 foot target altitude. The payload, housed in the nose cone, featured an experiment investigating the efficacy of **dielectric barrier discharge** (DBD) plasma actuators at high velocities.

The team developed an **experimental guided parafoil recovery system** requiring a variety of custom mechanisms and actuators (below) and a custom-built flight computer. The team also researched computer vision applications for guidance & control.



DBD Electrodes producing plasma



experimental parafoil system

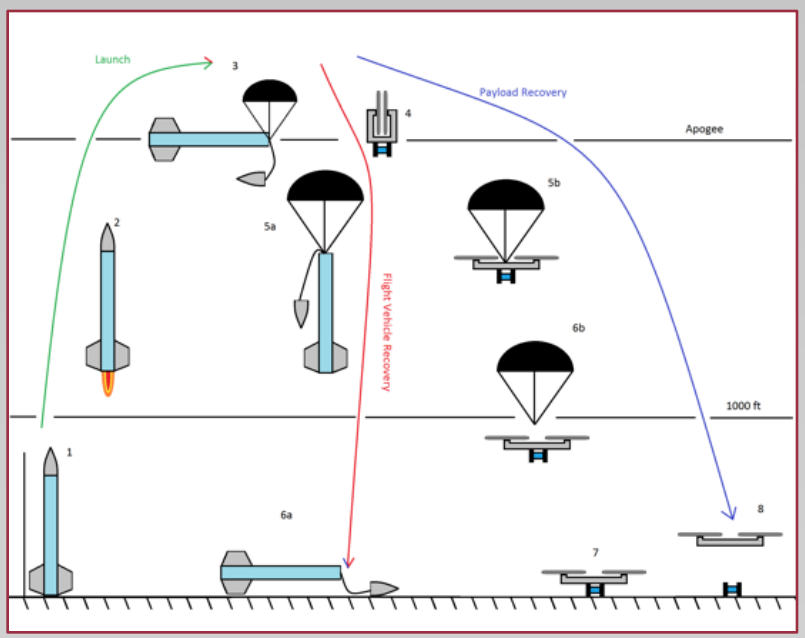
The DBD payload created a thin film of **high-velocity plasma**, reducing drag and increasing flow attachment on the affected surface. The experiment used this effect to attempt solid state roll control through plasma discharge. Wind tunnel tests suggested that the DBD actuators did reduce drag.

In June 2016, the team competed in IREC in Green River, UT. Therion weighed 72 pounds at liftoff, stood 11’8” tall, and reached an altitude of 9624 feet. Therion’s developments (above), pave the way for the Spaceport America Cup this year.

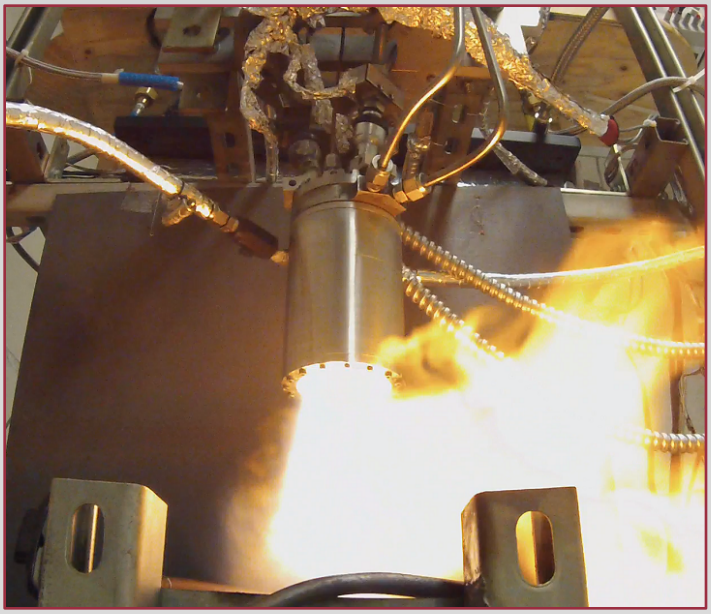
Spaceport America Cup 2016-2017

The team plans to compete in the Spaceport America Cup (formerly IREC), for which all major subsystems will be student-built. The main goal of this competition is to carry a 10lb cubesat experiment to 10,000ft. Leveraging the implementation of Therion, the key developments for this year include **custom solid propellants** and an **in-house, composite nosecone**.

Our payload project for this year is rover-based. The focus first is to successfully deploy and land the rover, pursue a technical mission, then develop a skycrane-style descent and landing system using a combination of a drogue chute and a folding quadcopter.



Proposed CONOPS for Spaceport America Cup 2017



Ignition of Pyralis, the team's previous liquid bipropellant aerospike engine. Achieved December 2014.

This year, we also plan to develop infrastructure to support a multi-year liquid propulsion project in addition to solids. To do this, we will cultivate the existing experience from previous projects, design a feasible engine, and work to build a development engine throughout the year. This way, the team can support rockets that are entirely student-designed and built from the ground up to begin taking on more challenging projects and higher altitudes.

By the end of this year, we plan to:

1. Compete in the Spaceport America Cup using custom solid propulsion.
2. Build and operate a modular test stand for solid and liquid engines.
3. Design a liquid rocket engine for a competition-scale rocket, and build a development version of that engine.

Sponsorship

The MIT Rocket Team's continued success is made possible by the generosity of forward-looking individuals and organizations. We have an extremely capable team with an intense drive and passion for education, outreach, engineering and, of course, rockets. With your support, we hope to further our mission and continue to produce future aerospace leaders. You have the power to enable us to fly higher than ever and to be a part of our success.

Sponsorship Levels

Sponsorship levels benefits are cumulative. All donations are tax deductible. We also accept donations in kind. Rocket Team's funds are managed through the MIT Edgerton Center.

GOLD: above $15,000
(used for radiation shielding)

- Logo prominent on all rockets flown by Rocket Team, apparel and website
- Promotion during all public appearances (i.e., outreach events, interviews, etc.)
- Availability of our team members for recruiting and giving presentations

INCONEL: above $10,000
(used for high temperatures and oxidation resistance)

- Logo on all rockets flown by Rocket Team, team apparel and website
- Regular project status updates
- Use of team photographs and videos

CARBON FIBER: above $4,000
(used for its incredible strength-to-weight ratio)

- Logos on all posters, documents and presentations produced and on website
- Access to team resume book

ALUMINUM: Under $4,000
(a very lightweight metal)

- Logo and promotion on team website

Budget

Operations: $12,500

Certification Rockets.....$2,500
Events/Outreach.....$1,500
Travel.....$5,000
Lab supplies.....$3,000
Publicity.....$500

Competition: $41,500

Operations.....$2,000
Avionics.....$4,000
Payload.....$3,500
Propulsion.....$14,000
Structures.....$6,000
Recovery.....$3,000
IREC Travel.....$9,000

Liquid Development: $8,000

GSE.....$6,000
Engine Development.....$2,000

Total.....$62,000

Prior Sponsors

Many thanks to our prior sponsors!

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